

IN THE CLAIMS:

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- 1 1. A method for maintaining cache coherency in a system having a
2 first controller and a second controller, comprising:
3 selecting a mirror cache line in a second controller to copy data into;
4 mirroring the data from a cache line in a first controller to the mirror cache
5 line in the second controller; and
6 sending a message from the first controller to the second controller
7 informing the second controller of cache meta data associated with the mirror
8 cache line.
- 1 2. The method of claim 1, wherein the first controller has information
2 about the content of the second controller's cache, and the second controller has
3 information about the content of the first controller's cache.
- 1 3. The method of claim 1, wherein the cache meta data includes a
2 logical unit, a logical block, a dirty bit map, and a cache identifier for the data
3 associated with the mirror cache line.
- 1 4. The method of claim 1 further comprising placing the address of
2 the mirror cache line into the first controller's hash table.
- 1 5. The method of claim 1 further comprising placing the address of
2 the mirror cache line into the first controller's write back queue.

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1 6. The method of claim 1 further comprising managing a free list of
2 mirror locations in the second controller's cache by the first controller, and
3 managing a free list of mirror locations in the first controller's cache by the
4 second controller, wherein the first and second controllers can copy data into the
5 second and first controller's mirror locations, respectively.

1 7. The method of claim 1, further comprising sending a message from
2 the first controller to the second controller, requesting ownership of a cache line
3 owned by the second controller.

1 8. The method of claim 7, further comprising granting ownership of a
2 cache line owned by the second controller, to the first controller, wherein,
3 subsequent to the first controller receiving data that is to be mirrored to the
4 second controller cache line, transferring data to the second controller's cache
5 line from the first controller.

1 9. The method of claim 8, further comprising sending a message from
2 the first controller to the second controller providing the second controller of
3 cache meta data associated with the mirror cache line.

1 10. The method of claim 1, further comprising switching ownership of
2 cache lines between the first controller and the second controller.

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1 11. The method of claim 1, further comprising, during failback,
2 transferring cache lines from a survivor controller that owns a substantial number
3 of mirror cache lines, to a replacement controller unit.

1 12. The method of claim 1, further comprising, sending a message to a
2 controller of a mirror cache line, informing the controller that the associated
3 cache line will be flushed and the data associated with the mirror cache line will
4 be temporarily invalid.

1 13. The method of claim 12, wherein sending the message to the
2 controller of the mirror cache line further comprises, informing the controller that
3 after the associated cache line is destaged, and the mirror cache line's data is
4 consistent with a backing disk and need not be written to the backing disk in the
5 event of a failover.

1 14. The method of claim 1, further comprising, indicating to the first and
2 second controller that a cache line that has been flushed of data, is available for
3 reuse.

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1 15. A controller system for maintaining cache coherency, comprising:
2 a disk array,
3 a first controller, coupled to the disk array, for selecting a mirror cache line
4 on a second controller; and
5 an interface for mirroring the data from a first controller cache line to the
6 second controller cache line;
7 wherein a message is sent from the first controller to the second controller
8 informing the second controller about cache meta data associated with the mirror
9 cache line.

1 16. The controller system of claim 15 wherein the first controller has
2 information about the content of the second controller's cache, and the second
3 controller has information about the content of the first controller's cache.

1 17. The controller system of claim 15, wherein the cache meta data
2 includes a logical unit, a logical block, a dirty bit map, and a cache identifier
3 associated with the mirror cache line.

1 18. The controller system of claim 15 further comprising the first
2 controller placing the address of the mirror cache line into the first controller's
3 hash table.

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1 19. The controller system of claim 15 further comprising the first
2 controller placing the address of the mirror cache line into the first controller's
3 write back queue.

1 20. The controller system of claim 15 further comprising the first
2 controller managing a free list of mirror locations in the second controller's
3 cache, and the second controller managing a free list of mirror locations in the
4 first controller's cache, wherein the first and the second controller can copy data
5 into the second and the first controller mirror locations, respectively.

1 21. The controller system of claim 15, further comprising the first
2 controller sending a message to the second controller, requesting ownership of a
3 cache line owned by the second controller.

1 22. The controller system of claim 21, wherein the second controller
2 sends a message granting ownership of a cache line owned by the second
3 controller, to the first controller, wherein, subsequent to the first controller
4 receiving data that is to be mirrored to the second controller cache line,
5 transferring that data to the second controller's cache line from the first
6 controller.

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1 23. The controller system of claim 22, further comprising the first
2 controller sending a message from to the second controller informing the second
3 controller of cache meta data associated with the mirror cache line.

1 24. The controller system of claim 15, wherein the first and second
2 controllers switch ownership of cache lines.

1 25. The controller system of claim 15, further comprising, during
2 failback, a survivor controller that owns a substantial number of mirror cache
3 lines transfers associated cache lines to a replacement controller unit.

1 26. The controller system of claim 15, wherein a message is sent to a
2 controller of a mirror cache line, informing the controller that the associated
3 cache line will be flushed and the data associated with the mirror cache line will
4 be temporarily invalid.

1 27. The controller system of claim 26, wherein the message that is sent
2 to the controller of the mirror cache line further comprises, informing the
3 controller that after the associated cache line is destaged, the mirror cache line's
4 data is consistent with a backing disk and need not be written to the backing disk
5 in the event of a failover.

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1 28. The controller system of claim 15, further comprising, indicating to
2 the first and second controller that a cache line that has been flushed of data is
3 available for reuse.

1 29. An article of manufacture comprising a program storage medium
2 readable by a computer, the medium tangibly embodying one or more programs
3 of instructions executable by the computer to perform a method for maintaining
4 cache coherency, the method comprising:

5 selecting a mirror cache line in a second controller to copy data into;

6 mirroring the data from a cache line in a first controller to the mirror cache
7 line in the second controller; and

8 sending a message from the first controller to the second controller
9 informing the second controller of cache meta data associated with the mirror
10 cache line.

1 30. A storage system for maintaining cache coherency, comprising:

2 means for selecting a mirror cache line in a second controller to copy data
3 into;

4 means for mirroring the data from a cache line in a first controller to the
5 mirror cache line in the second controller; and

6 means for sending a message from the first controller to the second
7 controller informing the second controller of cache meta data associated with the
8 mirror cache line.